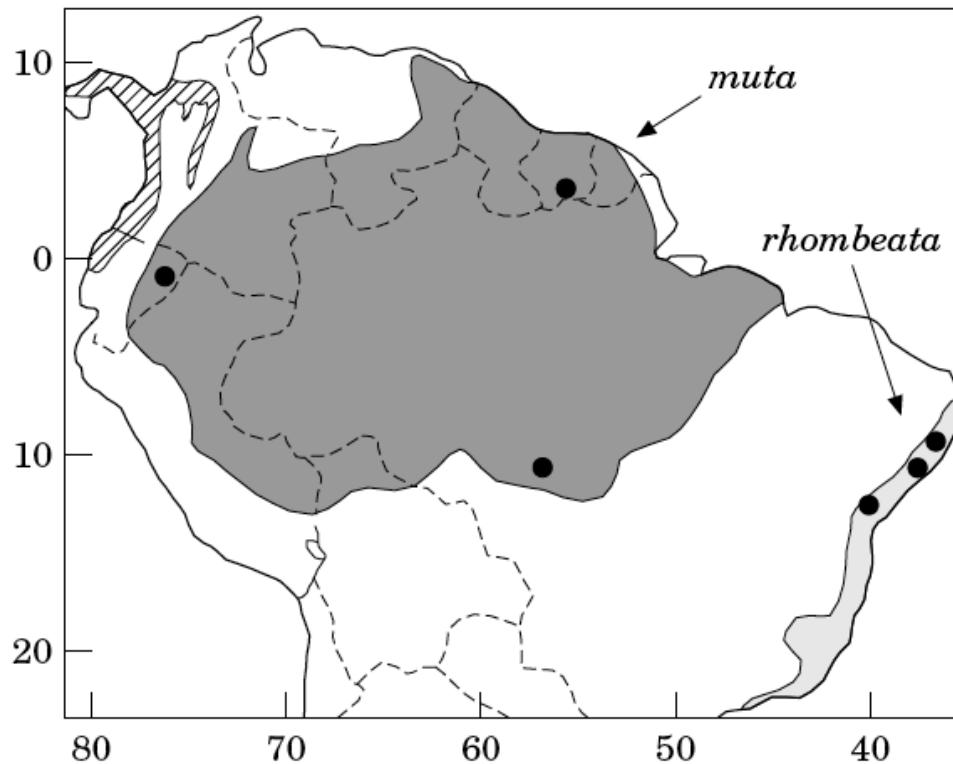


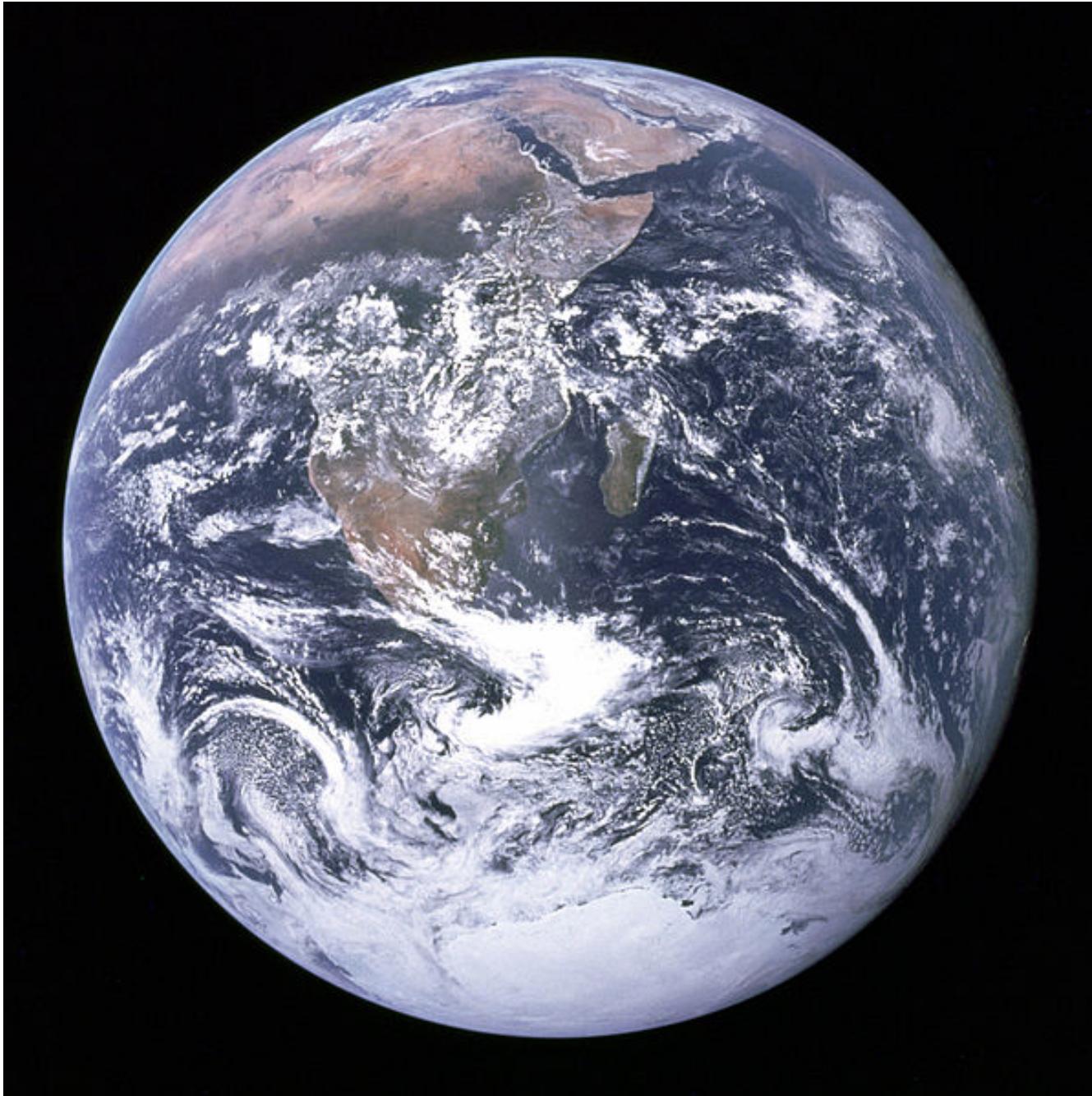
Biogeography and Phylogeography of Reptiles and Amphibians



Biogeography and Phylogeography

- **Biogeography** is the study of historical processes that affect the geographic distributions of animal and plant species
- **Phylogeography** is the study of historical processes that affect the geographic distribution of genetic variation within species

The difference between biogeography and phylogeography is mostly one of scale







Biogeography

Global Species Richness

- The global number of species is a balance between two processes
- **Speciation:** the formation of two species from one
- **Extinction:** the death of a species

How fast do new species form?

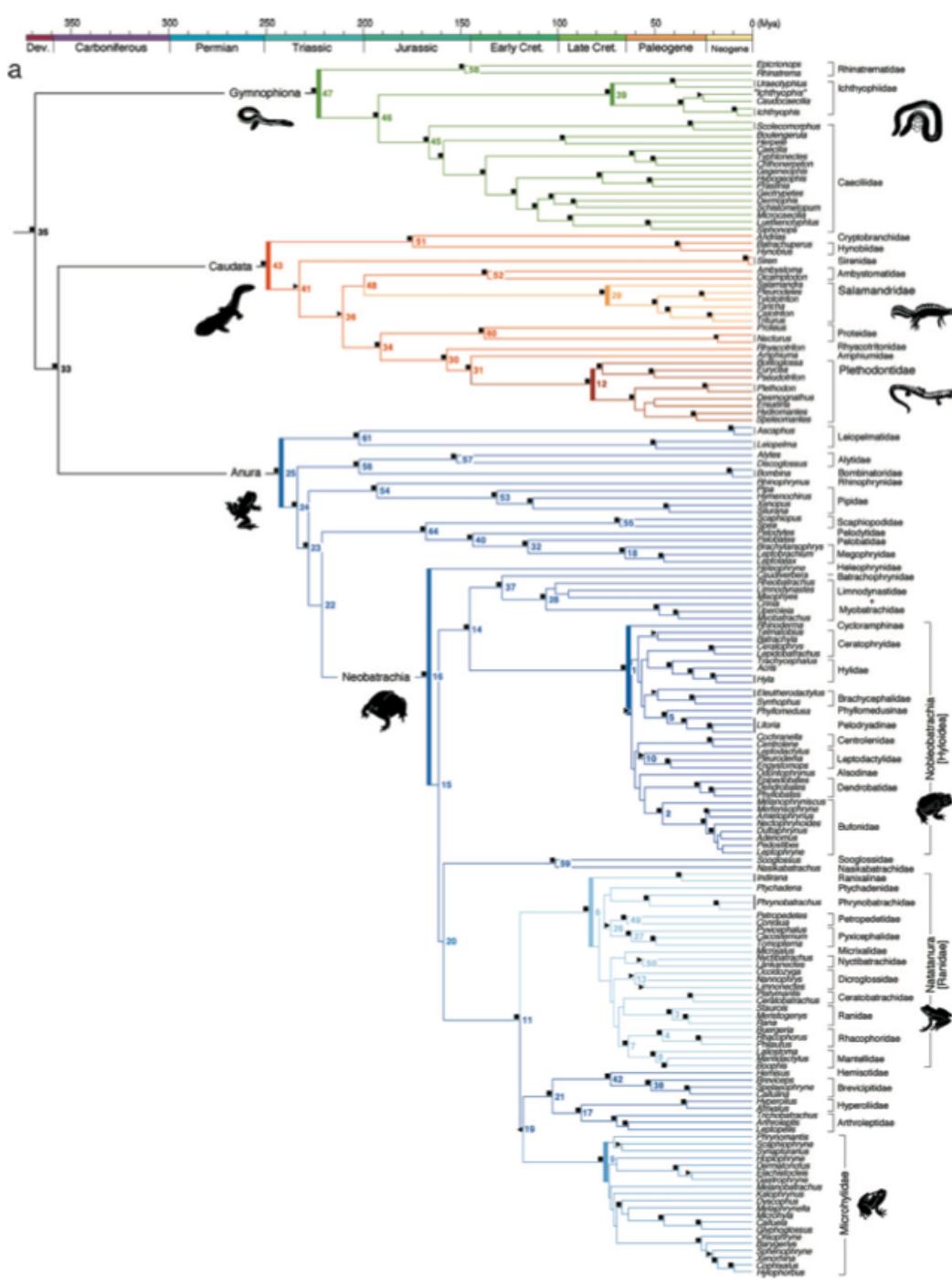
Global patterns of diversification in the history of modern amphibians

Kim Roelants*, David J. Gower†, Mark Wilkinson†, Simon P. Loader†, S. D. Biju*‡, Karen Guillaume*, Linde Moriau*, and Franky Bossuyt*§

*Unit of Ecology and Systematics, Vrije Universiteit Brussel, Pleinlaan 2, B-1050 Brussels, Belgium; †Department of Zoology, Natural History Museum, London SW7 5BD, United Kingdom; and ‡Centre for Environmental Management of Degraded Ecosystems, School of Environmental Studies, University of Delhi, Delhi 110007, India

Edited by Francisco J. Ayala, University of California, Irvine, CA, and approved November 21, 2006 (received for review September 22, 2006)

create phylogenetic tree using 5 genes
(one mtDNA, 4 nDNA)



Cyphophrys

Andrias

Batrachuperus

Hynobius

Siren

Ambystoma

Dicamptodon

Salamandra

Pleurodeles

Tylototriton

Taricha

Calotriton

Triturus

Proteus

Necturus

Rhyacotriton

Amphiuma

Bolitoglossa

Eurycea

Pseudotriton

Plethodon

Desmognathus

Ensatina

Hydromantes

Speleomantes

Cryptobranchidae

Hynobiidae

Sirenidae

Ambystomatidae

Salamandridae



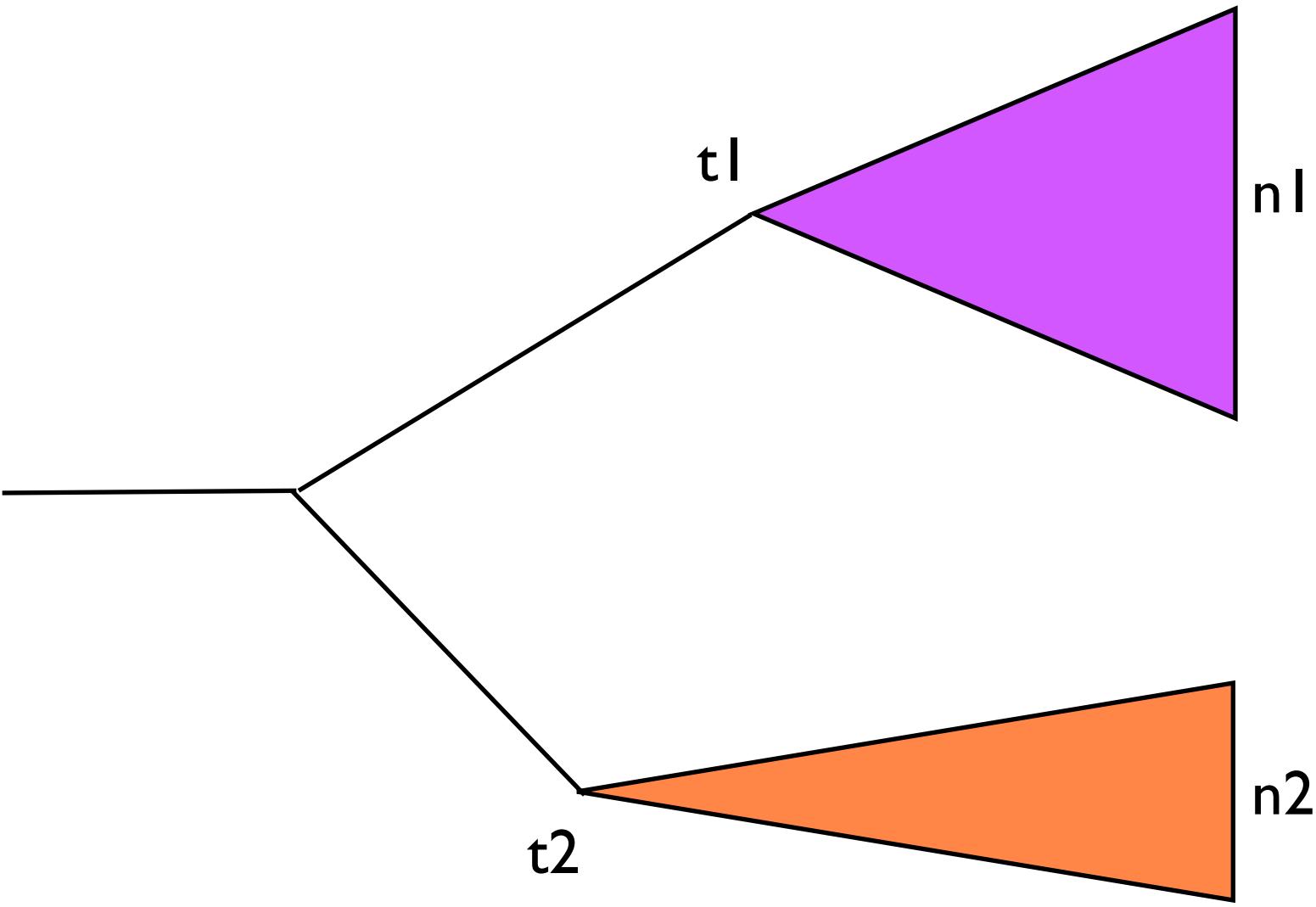
Proteidae

Rhyacotritonidae

Amphiumidae

Plethodontidae



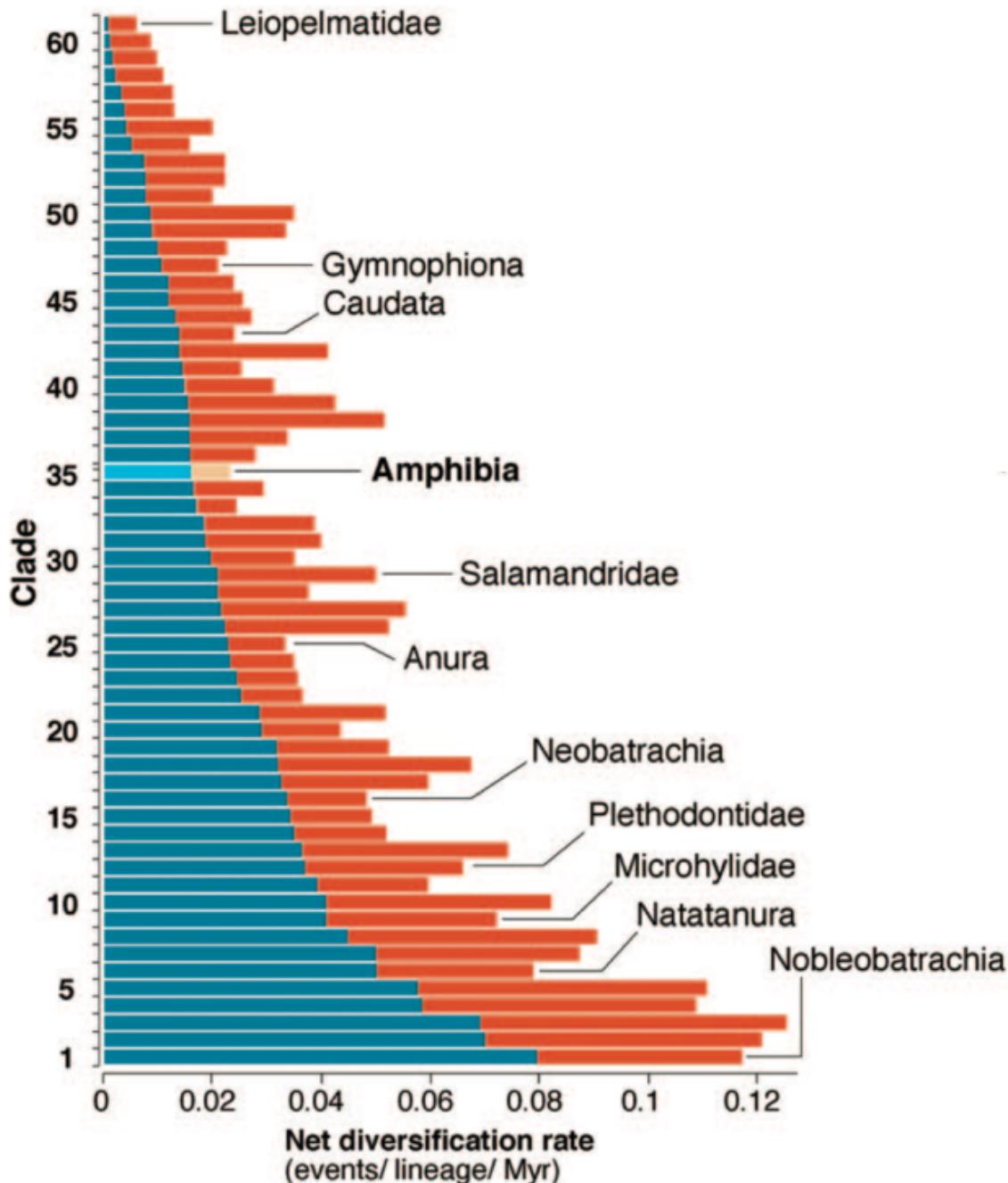


Net diversification rate:

speciation - extinction

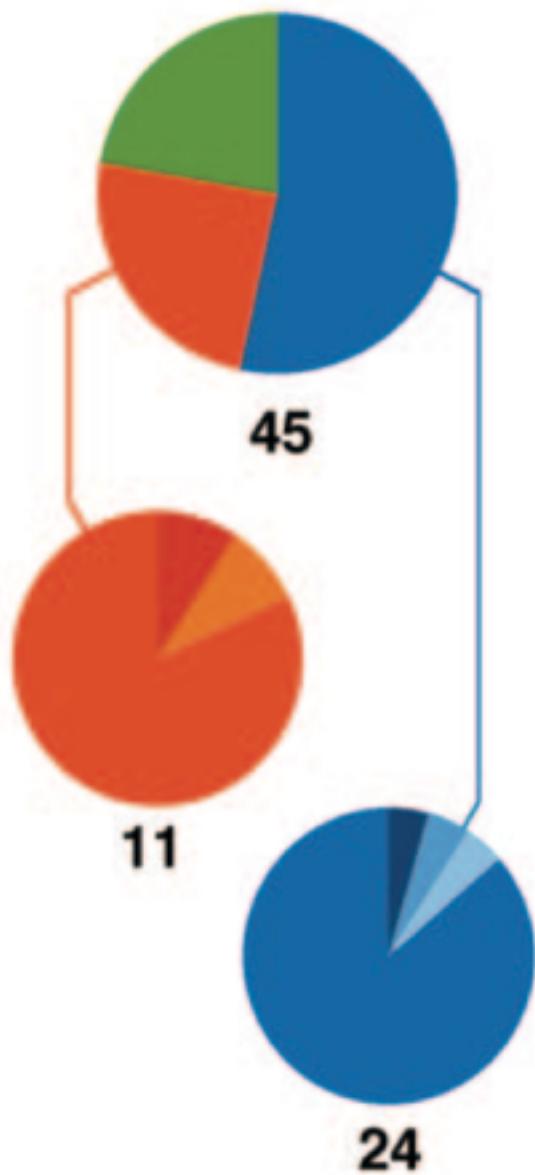
**Net diversification rates vary tremendously
across clades**

b

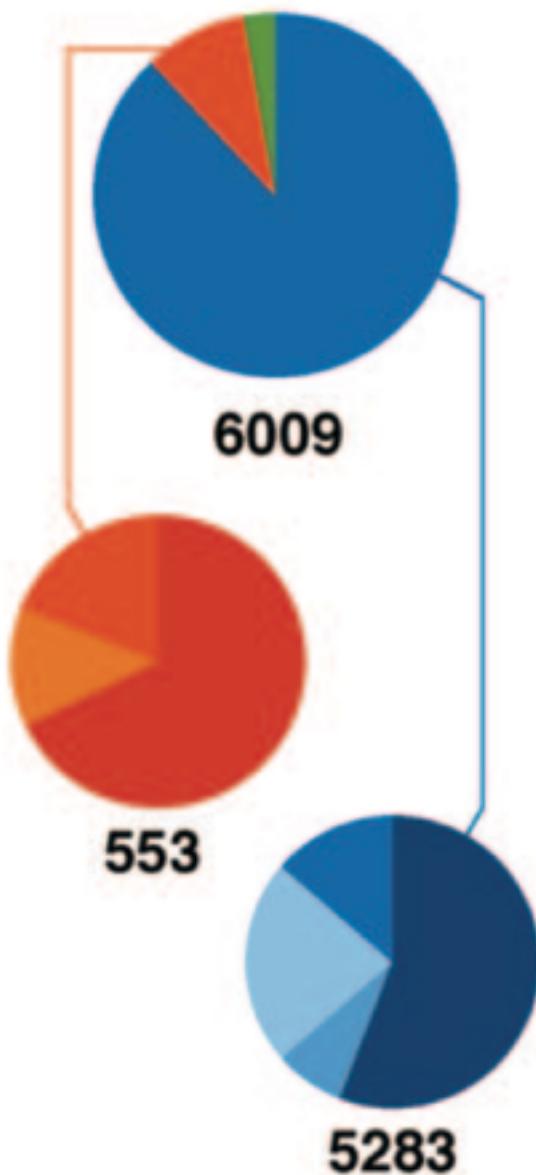


Species composition differed in the past

Late Cretaceous
(99.6 Mya)



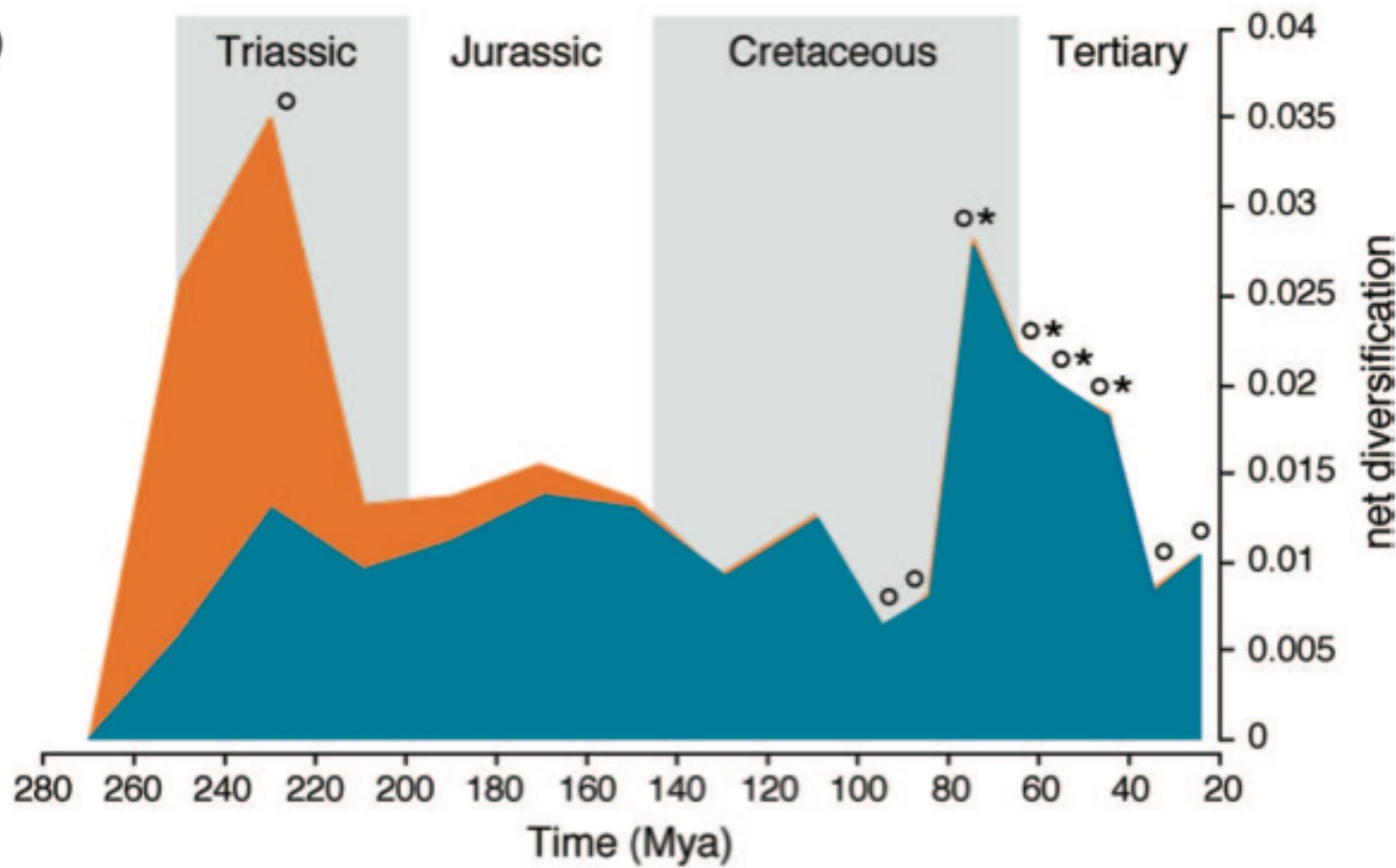
Present



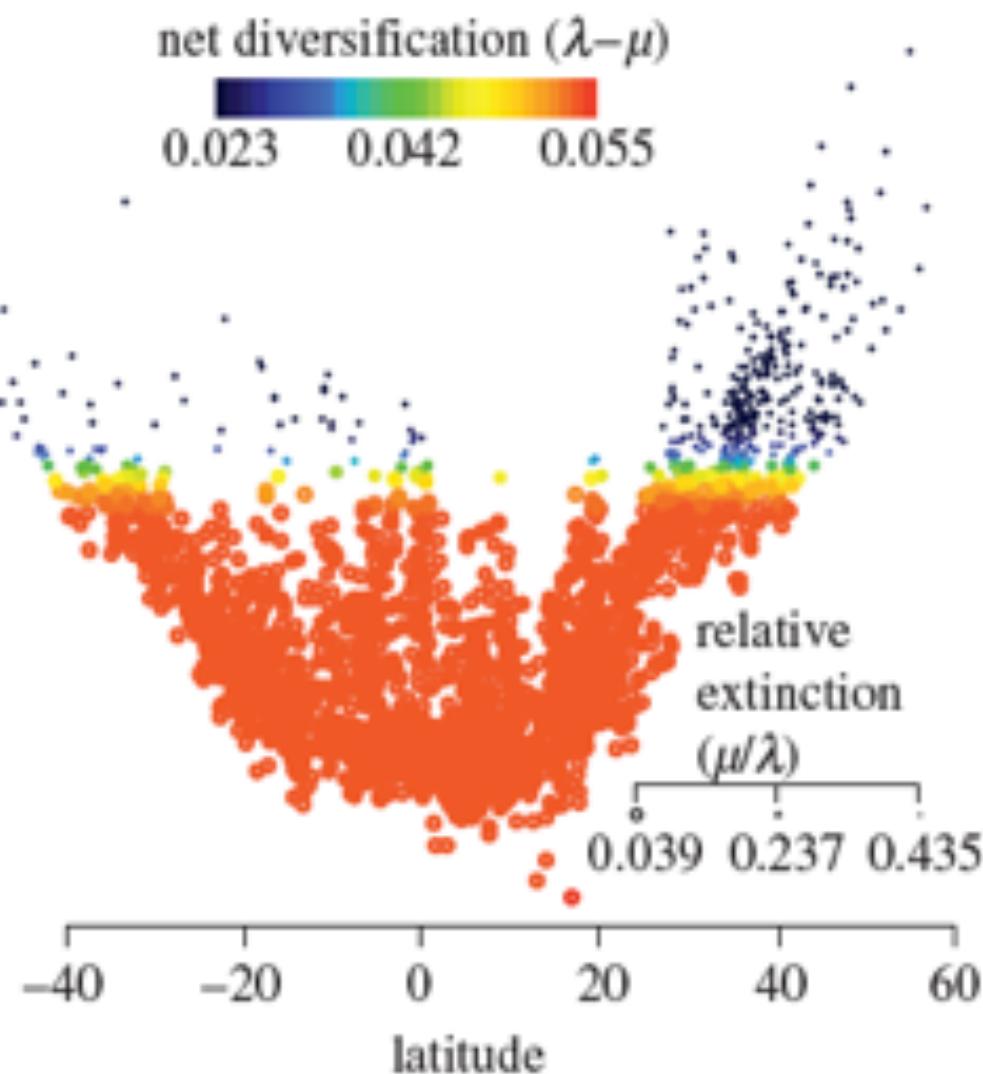
- Gymnophiona
- Caudata
- Salamandridae
- Plethodontidae
- Anura
- Natatanura
- Microhylidae
- Nobleobatrachia

Diversification rates have varied through time

b



Diversification rates have varied through space



6

Lungfish

Gymnophiona

Anura

Caudata

Mammalia

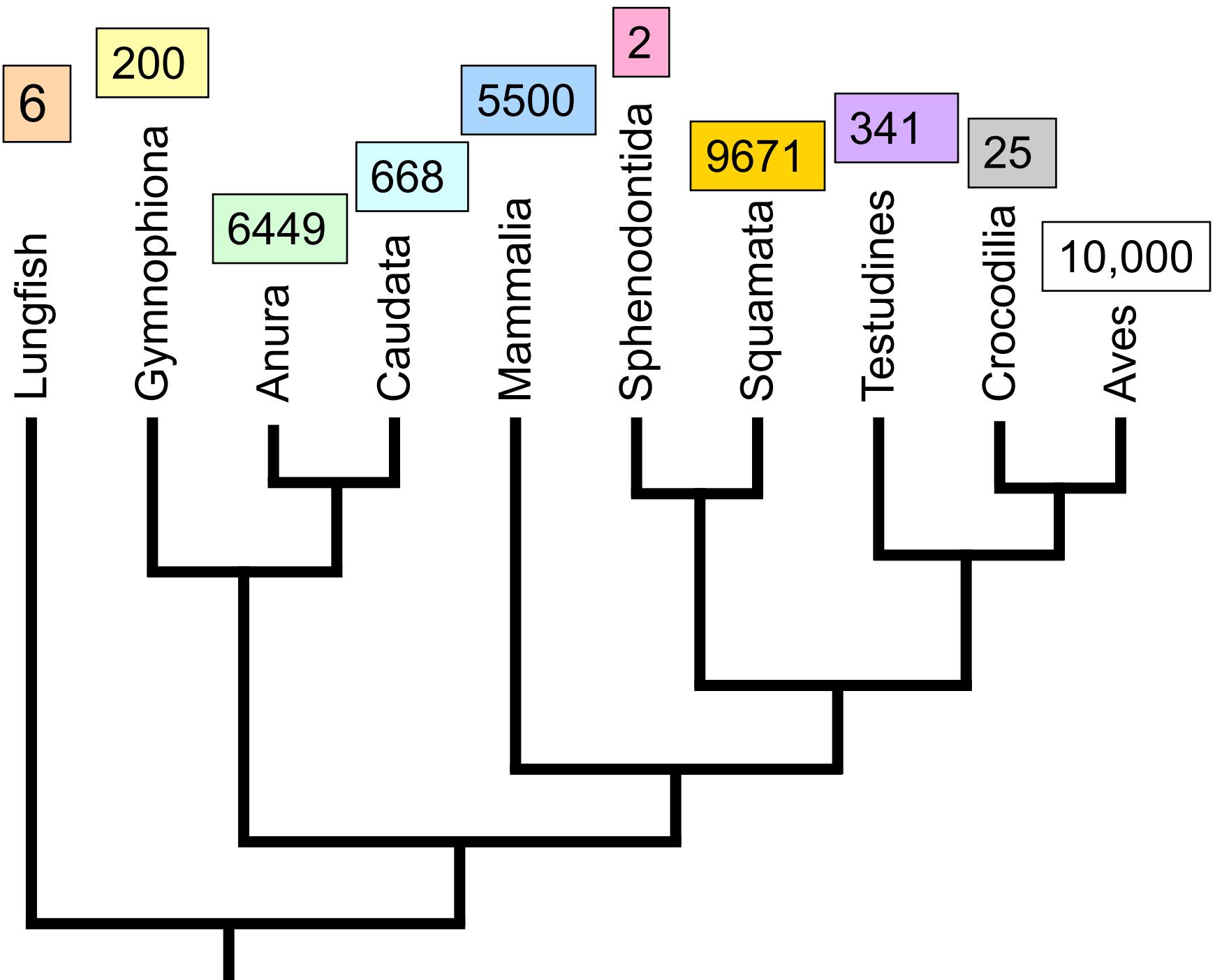
Sphenodontida

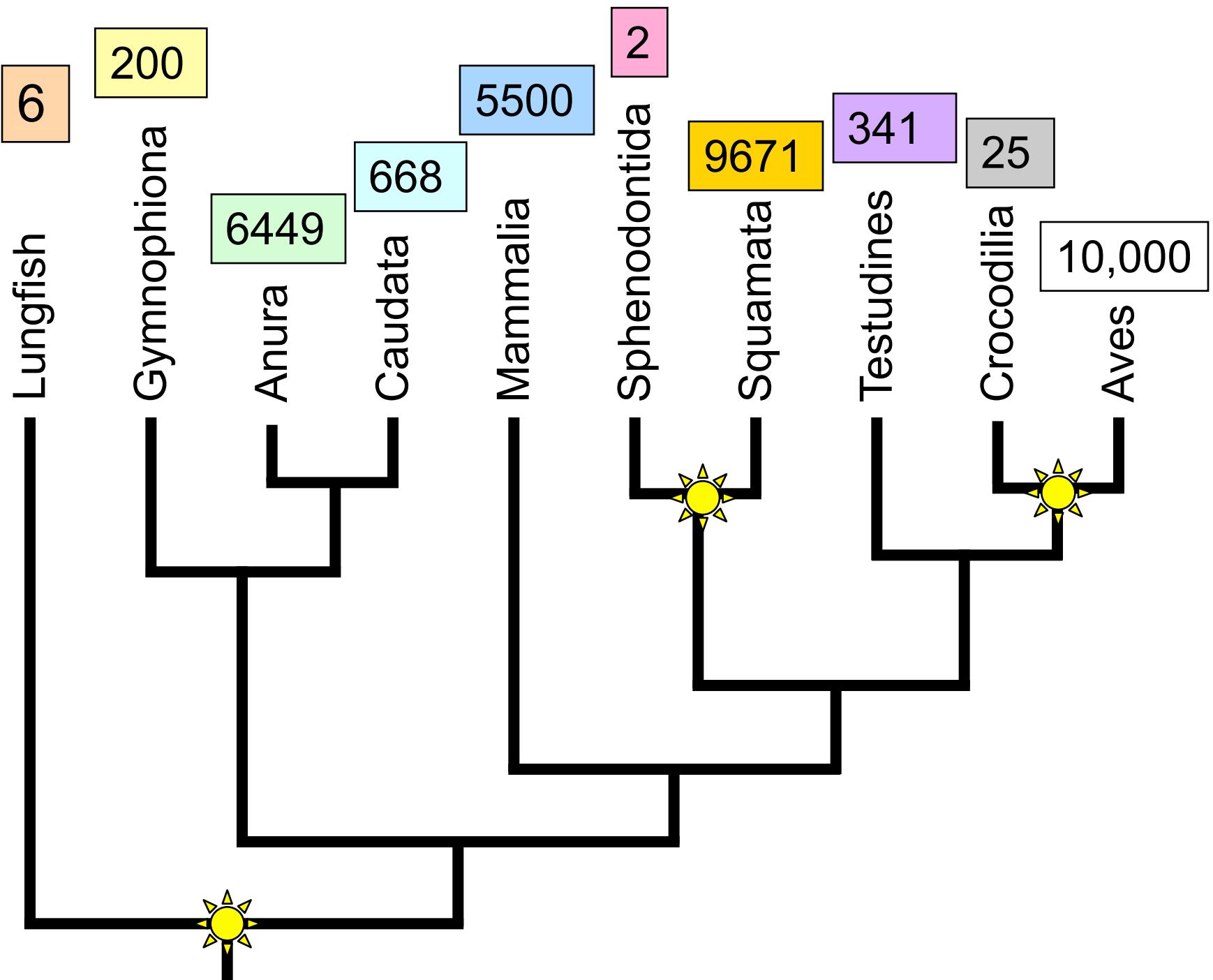
Squamata

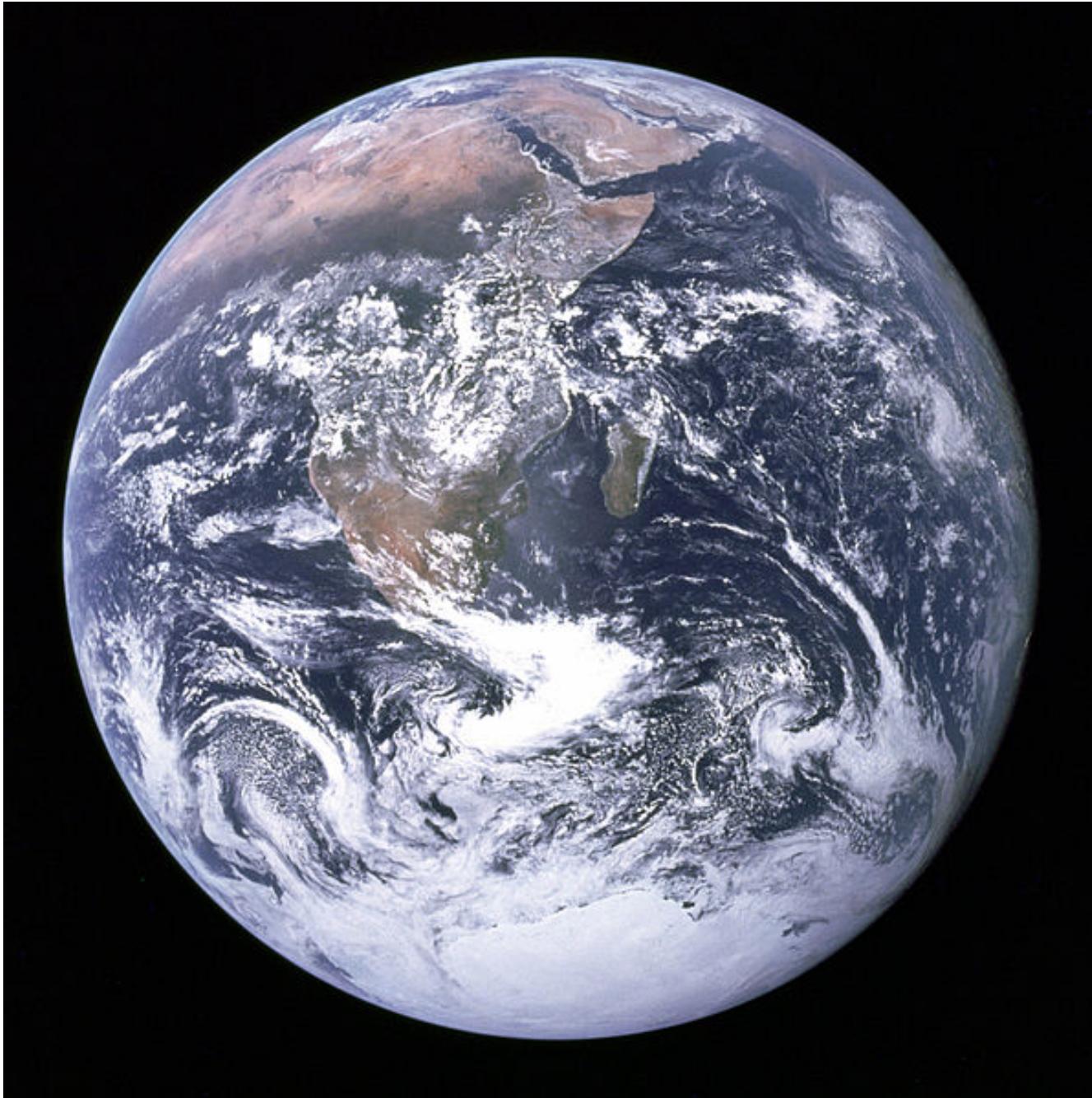
Testudines

Crocodylia

Aves









Historical Biogeography

- Study of the interaction between geography, ecology, and evolution
- Why are species found in the places where they live?
- Special problems: disjunct distributions, endemic species

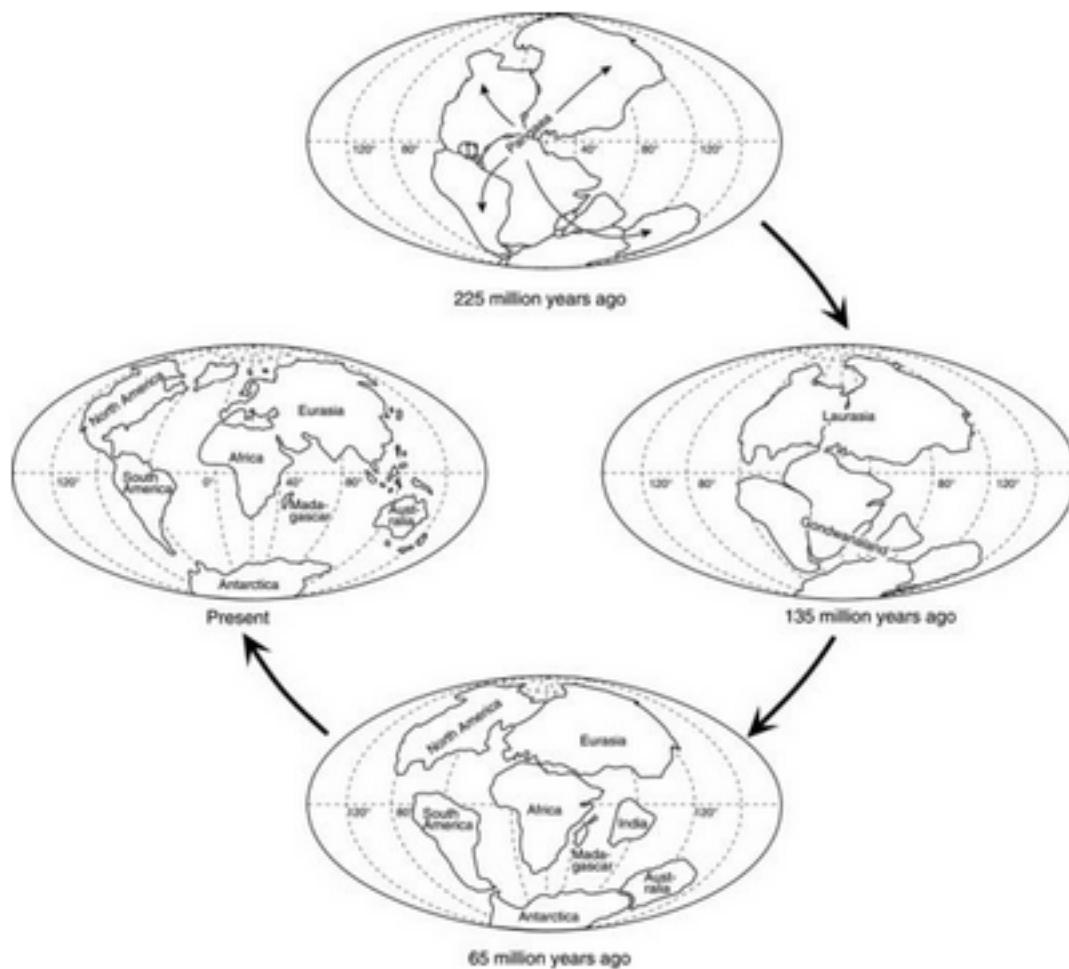
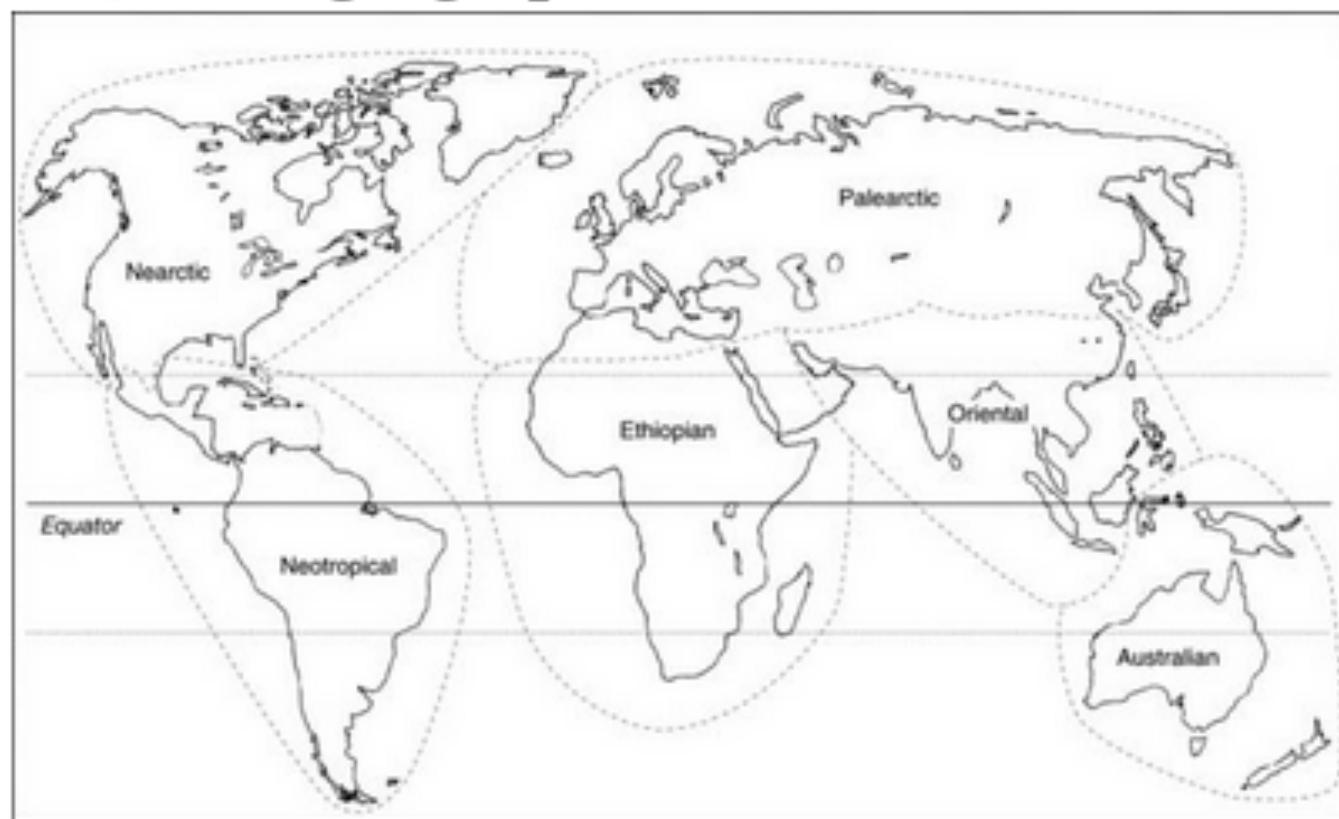


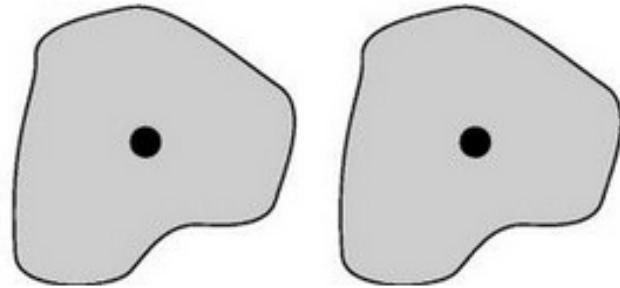
Figure 13.6. Biogeographic realms of the world.

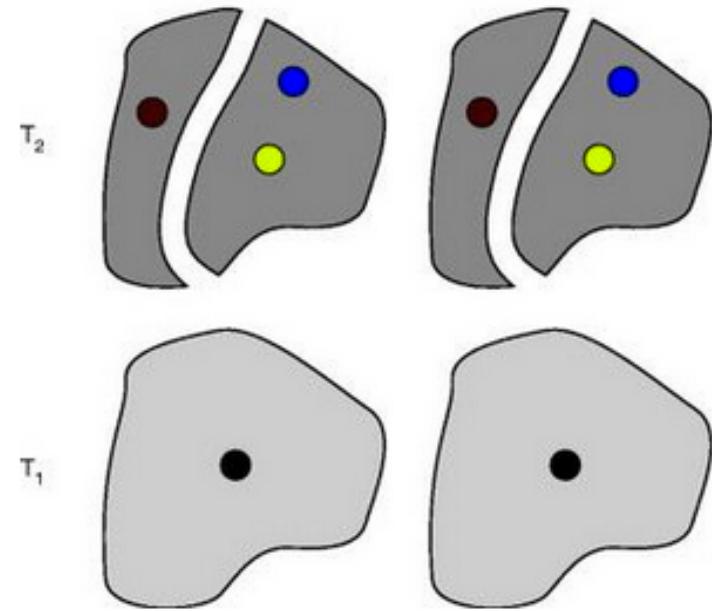


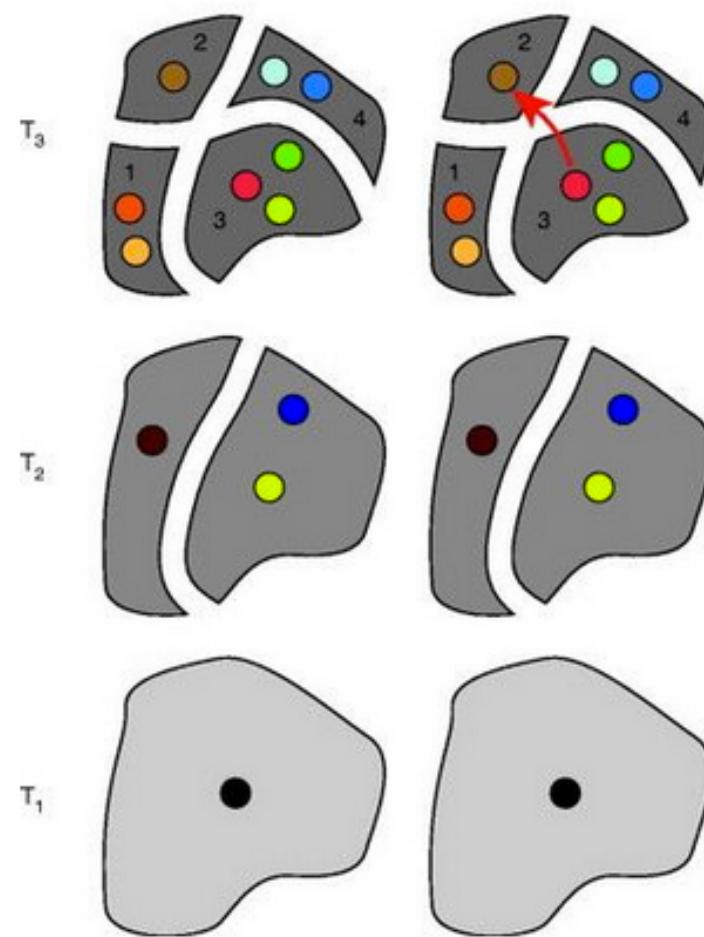
Main Biogeographic Explanations

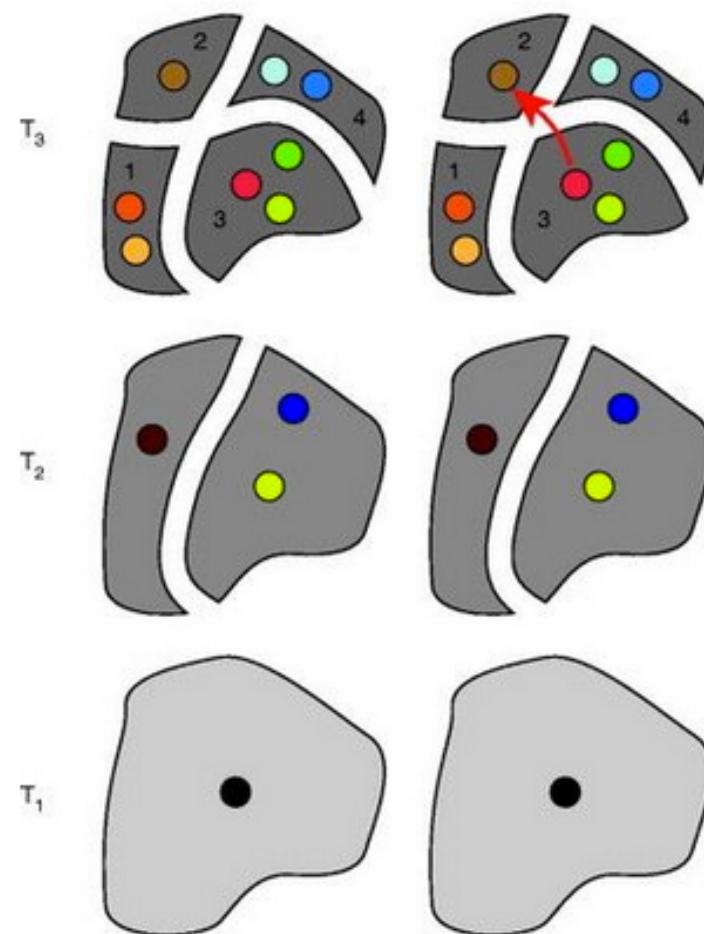
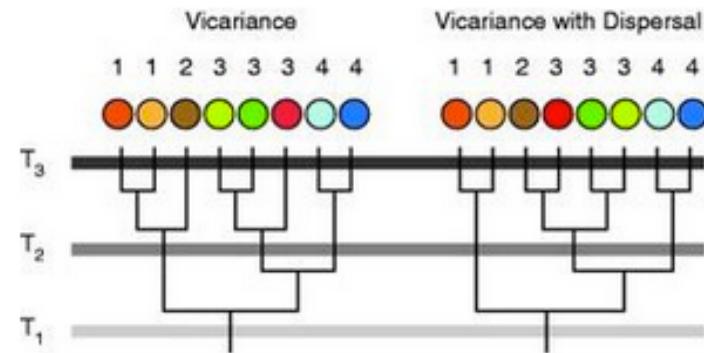
- Vicariance: species ranges are explained by splitting due to the formation of barriers
- Dispersal: species ranges are explained by movements (dispersal) into new areas

T_1

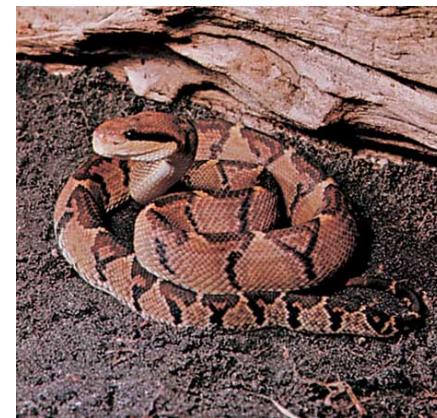
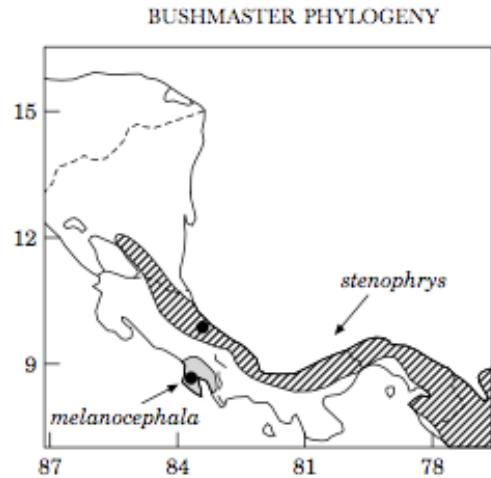




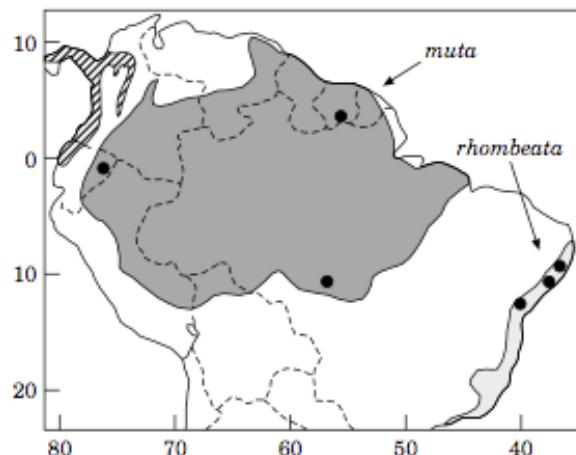




Vicariance Example

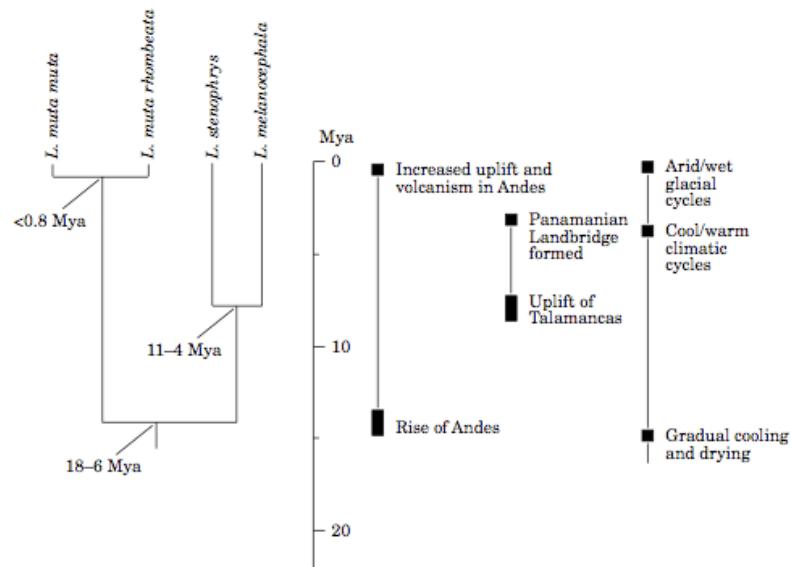
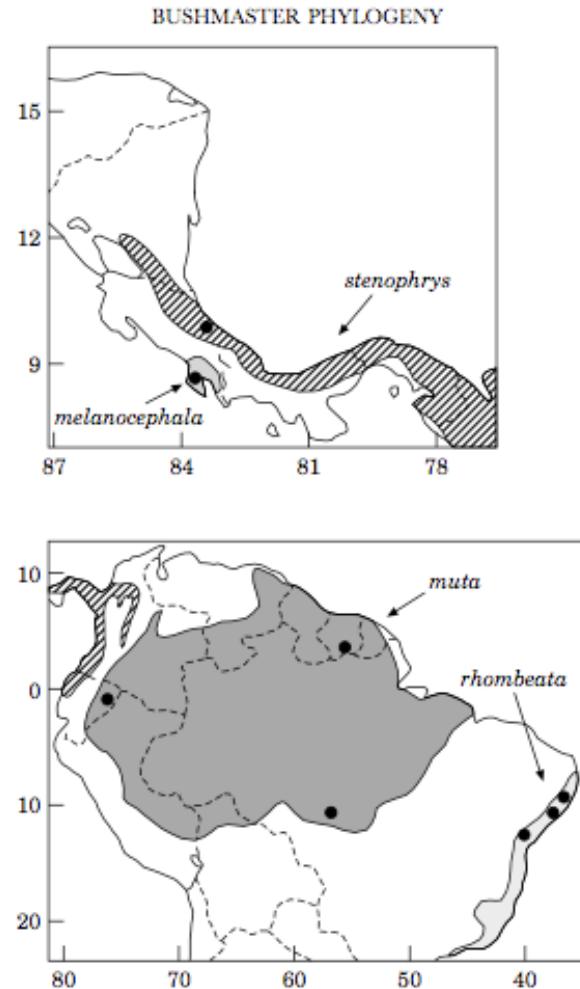


Lachesis muta

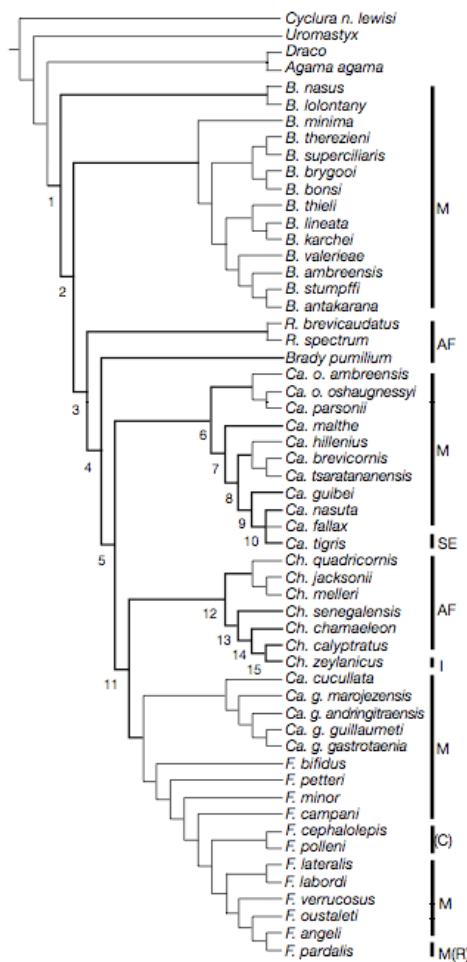


Zamudio and Greene 1997

Vicariance Example



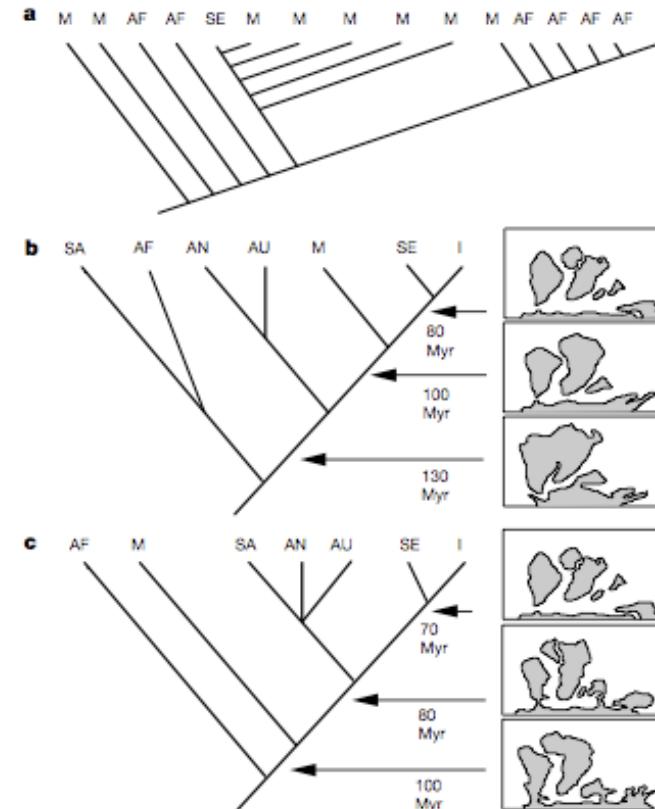
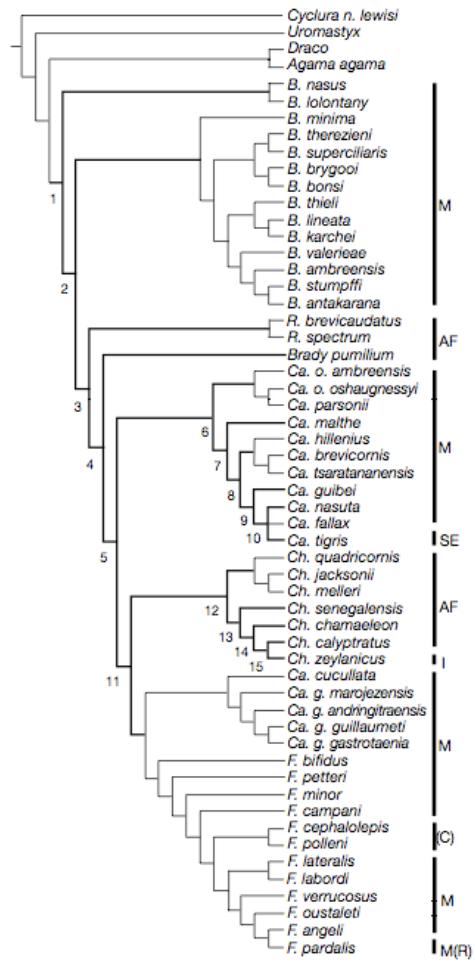
Dispersal Example

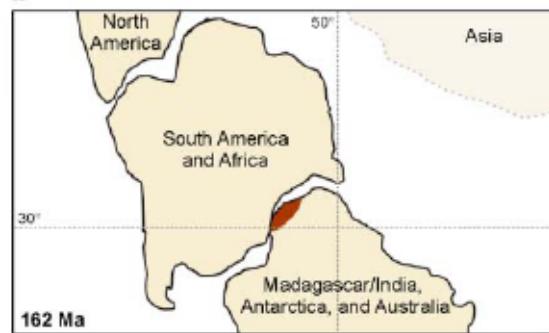
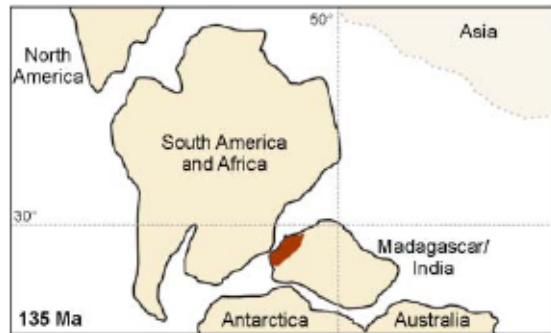
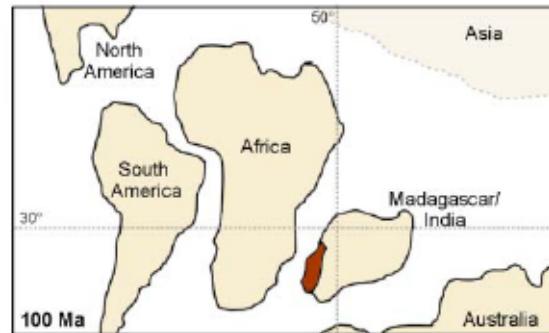
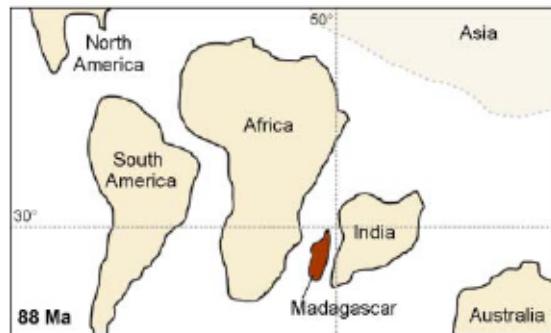
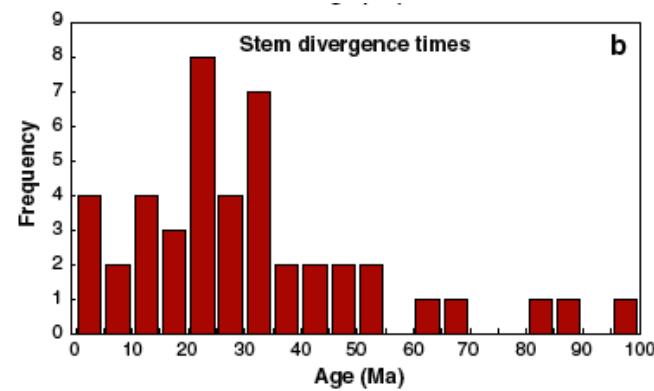
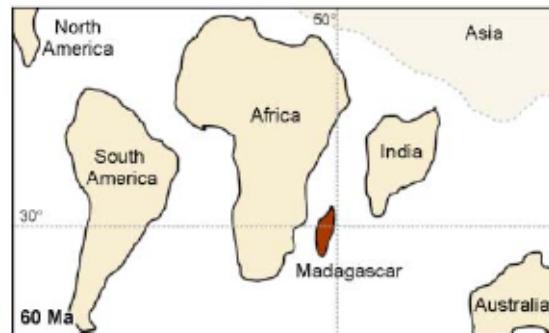


Chamaeleo parsonii



Dispersal Example



a**b****c****d****e****f****Figure 1**

Notice: timing is key!

Modern Biogeography

- Use phylogeny plus distributional data
- Infer the history of taxa: vicariance, dispersal, both?
- Infer the history of areas: concordant patterns among taxa reflect Earth's history





Phylogeography

- Sample many individuals within one or a few closely related species
- Cover the species' geographic range
- Sequence DNA
- Analyze spatial patterns of genetic variation within and across species

Phylogeography

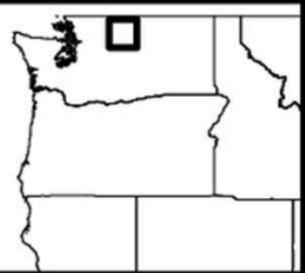
- Study migration and gene flow across a landscape
- Investigate population fragmentation and speciation

RESEARCH ARTICLE

Do dams also stop frogs? Assessing population connectivity of coastal tailed frogs (*Ascaphus truei*) in the North Cascades National Park Service Complex

Jared A. Grummer¹ · Adam D. Leaché¹

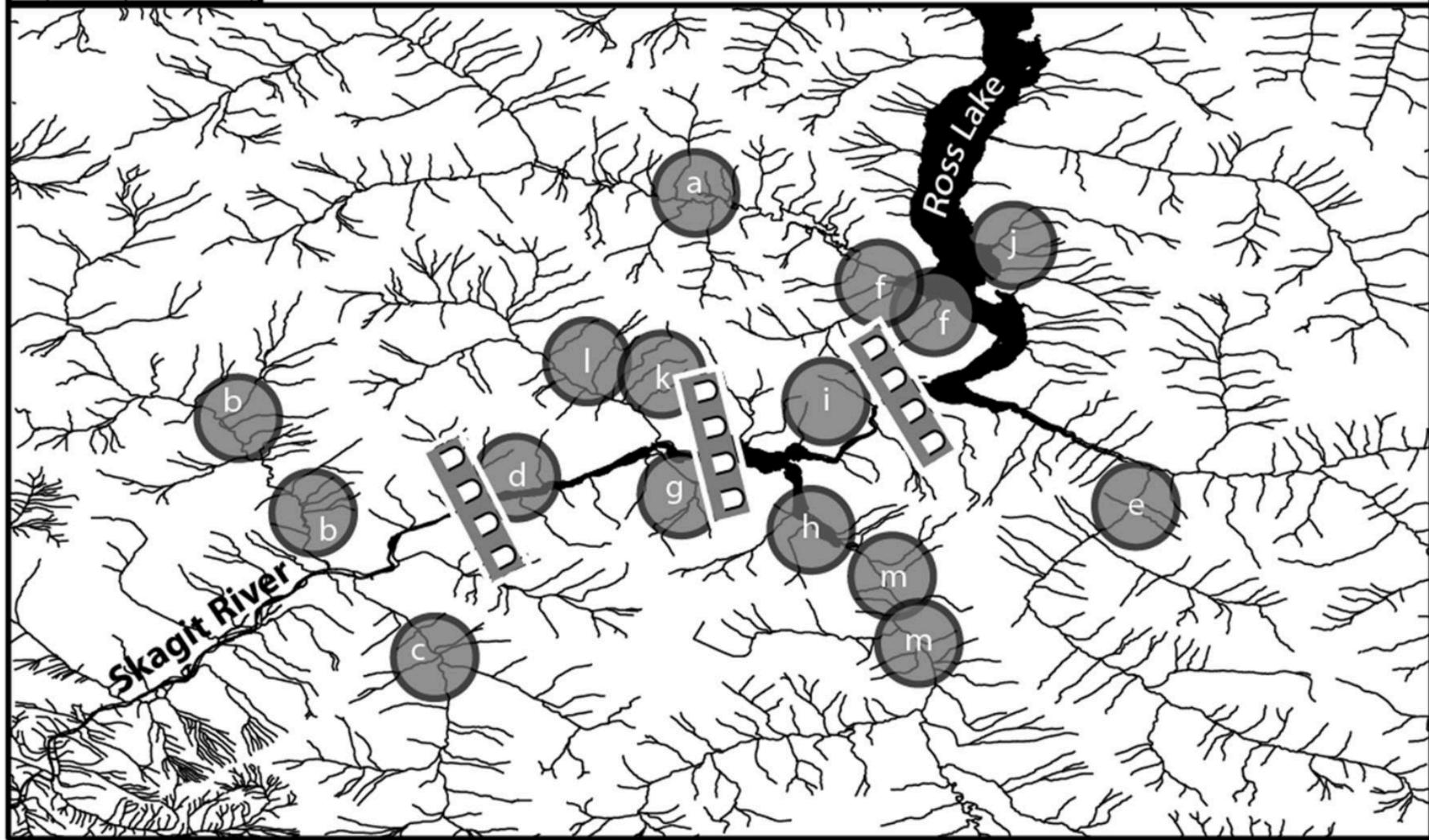
Received: 6 July 2016 / Accepted: 23 December 2016 / Published online: 30 January 2017
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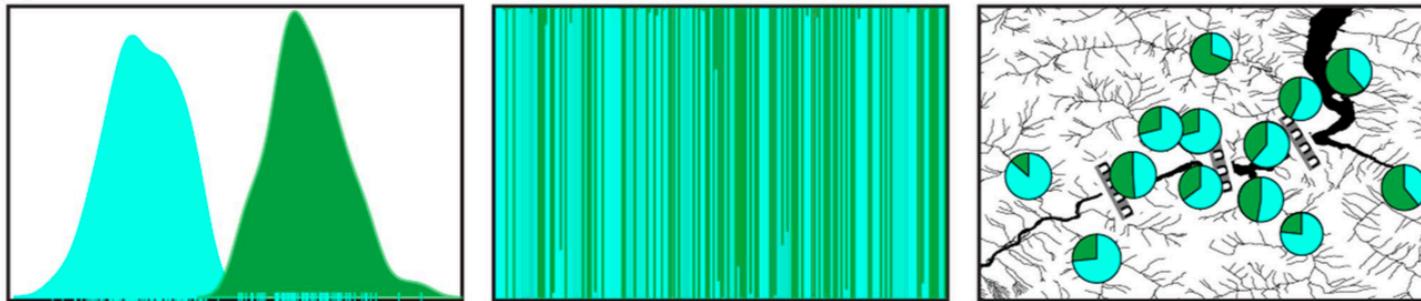
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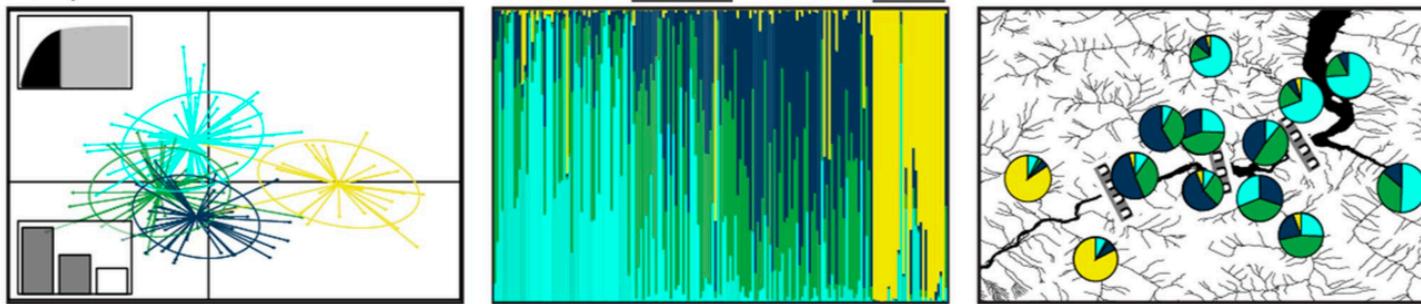
20km



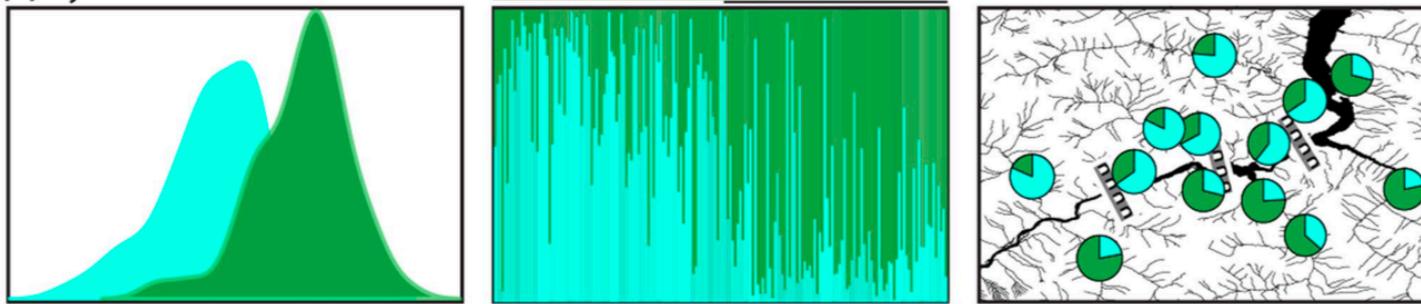
(a) de novo



(b) by dams



(c) by river



(d) by river and dams

